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ETIOLOGY AND TREATMENT OF FAULTY BODY MECHANICS IN CHILDHOOD *

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In the absence of new facts, one's purpose in presenting a subject should be the tabulation of accurate clinical observations, together with a discussion of their practical application. The mechanical factors governing improper attitude are rather definitely described, and it is only their relationship to metabolism that opens new lines of discussion.

TYPES

Individuals are easily classified into three distinct types, depending upon the body structure, and have been so considered by Treaves and Bean after their anthropological investigations. Of the various classifications perhaps that of Bean is the most satisfactory, in which he speaks of the heavy type as the hypo-ontomorph; the thin individual, lighter in weight than the preceding, as the hyper-ontomorph; and the mean or neutral as the meso-ontomorph, this last being the normal type. Further studies, especially those of Brown and Cook, would lead us to believe that the line of demarcation between the normal and abnormal type is rather too closely drawn in this form of classification; for certain mild variations into the class of hypo-ontomorphs and hyper-ontomorphs, because of

their frequency and the normal function of the individuals, must still be classed as normal. However, the term "normal" should be differentiated from the phrase "mechanically perfect."

The anatomical findings are fairly constant for each particular type. The hypo-ontomorph has the forward head and shoulders, somewhat flattened chest, large heavy abdomen, and body well covered with a thick layer of superficial fat. The whole picture is of a heavy and, as emphasized by Goldthwaite, herbivorous individual.

The hyper-ontomorph is undernourished, the head and shoulders are forward, the chest is appreciably flattened, the epigastric angle acute, the intercostal spaces narrow, the scapulae flaring, the normal lumbar lordosis exaggerated, the normal dorsal curve increased and the abdominal wall relaxed. This individual is well described as the carnivorous type.

Data concerning the pathological findings as revealed by autopsy, is rather meager. Bryant, as quoted by Osgood, stated that three hundred autopsy records show that the hyper-ontomorph or carnivorous type is associated in a large percentage of the cases with abnormal intestinal adhesions. Bean, also quoted by the same writer, observed a thousand and two patients with three hundred and seventeen autopsies which showed the stomach small and low, "J" shaped, and far to the left; the liver, small, low, vertical and far to the right. The small intestines were short and of small caliber, the colon was long with a low hepatic and a high splenic flexure, while the transverse portion was a low-hanging loop with a long mesentery. Just what the meaning of such changes may be, if we may consider them pathological, is open to considerable discussion. The advent of the X-ray has changed somewhat our conceptions concerning the position of the stomach, small intestine, and colon. However, it does seem reasonable to believe that an elongated mesentery would be detrimental to the transmission of impulses along the sympathetic trunks, which our physiologists tell us play an important part in digestion.

We know that stretching of peripheral nerve trunks inhibits the conduction of motor impulses. The same principle should be applied to the trunks of the sympathetic nerves which pass through an abnormally elongated mesentery. The flattening of the chest with a diminution in intrathoracic space must mechanically interfere with proper oxygenation of the blood stream. We know that the hyper-ontomorph is more susceptible to disease,

* Read before the Annual Meeting of the Medical Society of the State of California, May, 1922.

particularly to tuberculosis. Improper aeration of the blood stream and the improper aeration of the local organs themselves, must of necessity produce a locus minorus resistentii, which is in its beginning fundamentally mechanical in origin.

The question of nutrition is an important factor which is not considered except in a brief manner because there can be no discussion concerning the changes which follow loss of muscle tone due, primarily, to inanition. However, the mechanical changes in the body form following such a condition, should be commented upon at length because of the vicious circle which is established if mechanical measures are not employed to relieve these changes in attitude which so interfere with the recovery of the child.

After a poorly nourished child has maintained a position of faulty attitude for a considerable period of time, the disturbances in muscle balance become fixed, due to weakening of the overstretched muscle groups and contractures of their antagonists. This situation applies just as truly to improper body mechanics as it does to contractures of the posterior calf groups when bedclothes have been allowed to maintain a foot in a position of plantar flexion. The forward position of the head results in relaxation of the posterior neck muscles and shortening of the anterior groups. In the same manner flattening of the chest and narrowing of the intercostal spaces allow contractures of the intercostal and triangularis sterni muscles to develop. The pectoral groups are definitely shortened when the shoulders are forward, while, in turn, the serratus anterior muscle, which holds the scapula in apposition with the chest wall, is relaxed. The muscles of the abdominal wall become atonic, the erector spinae loses its tone because of overstretching, the tibial groups become overstretched and often the peroneal groups are shortened, giving rise to foot pronation. This, in a brief way, pictures a truly orthopaedic problem.

Improvement in nutrition will have little effect upon improper attitude. No matter how much improvement there may be in muscle tone, the mechanical conditions remain fixed unless mechanical measures are utilized to overcome the muscular contractures and improve the atonic groups. If this condition of improper attitude is allowed to persist, we may have a postural scoliosis transformed into a structural one. The flattening of the chest and the narrowing of the epigastric angle become permanent. These fixed bony changes are, of course, the most difficult to deal with and often are not benefited by corrective measures.

CLINICAL MANIFESTATIONS

Talbot and Brown have discussed the relationship of faulty attitude to chronic constipation, cyclic vomiting and the disturbances in the digestion of fat which are associated with these conditions. Cases of obscure abdominal pain resembling appendicitis, which were relieved by correction of faulty attitude, are also cited.

In the seventeen cases that were studied in the preparation of this paper there were no instances of cyclic vomiting, obstinate chronic constipation

or obscure abdominal pain. These children were referred to the posture clinic of the Children's Hospital for the correction of faulty body mechanics, because of fatigue and because they could not be made to gain in weight. Three of these cases complained of severe frontal headache, which could not be accounted for. These children were under observation for an average of 45.7 days each. Fifteen were under weight from twelve and a quarter to seven-eighths of a pound; while one was three pounds, and another four and one-half pounds overweight. In the beginning these children were given individual attention in the posture clinic with stretching of contracted muscles as the primary objective. They reported three times a week for instruction, and were weighed weekly. Sixteen of these patients gained steadily, while one continued to lose weight. The average gain per day of normal children with ages and heights corresponding to the group studied, was found to be .23 of an ounce, while the average gain per day for this group of children was brought up to 1.07 ounces per day. However, it does not seem justifiable to attribute this rapid gain entirely to improvement in body mechanics, because the routine management of these cases requires, in addition to their postural exercises, a thirty-minute rest period each day.

TREATMENT

Before attempting to correct faulty attitude, it is well to consider briefly the normal body mechanics.

In the first place, the head should be erect so that a vertical plane, passing through the ear would pass through the point of the shoulder and the trochanter major. It is surprising to see the difficulty with which children attempt to stand correctly. When a child is instructed to assume a proper attitude, the shoulders are invariably thrown back in an abnormal position; the lumbar lordosis is increased and the whole attitude becomes one of imperfect mechanical poise. Assuming a normal attitude is, in reality, such a simple matter that it may be explained in one short sentence: Hold the head erect and draw the abdomen in. If this is done the shoulders, by gravity, assume a correct position, the antero-posterior diameter of the thorax is increased, and the individual assumes a position mechanically perfect. A certain amount of rotation of the pelvis posteriorly follows the abdominal retraction. This, of course, decreases the lumbar lordosis which so frequently is present. These two maneuvers, particularly pelvic rotation, are often difficult to attain and may require considerable practice in the recumbent position before they can be accomplished while the individual is erect. Since they form the basis of proper attitude, they are so important that sufficient attention should be devoted to them to enable the individual to accomplish them without great voluntary effort.

Concerning the group of cases which present themselves for treatment with faulty attitude of long duration, a question of muscle training must be considered. The presence of fixed soft-tissue

deformities has been considered, and these must be relieved by proper mechanical stretching as the first step in the rectification of this faulty picture. Contracted pectoral muscles will not allow replacement of the shoulders, and passive stretching should be employed until these shoulders may be easily replaced. This same condition applies to the shortening of all other muscle groups. As the contractures have been overcome, the problem of increasing tone in the relaxed muscle groups should be attacked and managed in the same way that a weakened muscle group would be treated after infantile paralysis. This phase of the treatment of faulty attitude requires an endless amount of patience on the part of the child, the parents, the physiotherapist who is actively working with the child, and the medical director. Results cannot be attained in days, and it means perseverance for weeks and months.

Proper hygienic surroundings, adequate food of a nutritious character and regulation of the rest periods, are of great importance in the management of cases with faulty attitude that are physically below par. It is needless to say that mechanical obstructions in respiratory passages should be removed; also, errors in vision must be rectified before permanent correction of a forward head and round shoulders can be maintained, for a child who finds it necessary to bury his face in a book in order to read, is placed in a position of unfair mechanical disadvantage. These errors in vision cause an involuntary stooping forward which has a decided effect upon the normal muscle balance of the head and shoulders.

MECHANICAL APPLIANCES

As a general rule the use of mechanical appliances in the treatment of faulty body mechanics, should be discouraged. There are instances, however, where their use is justifiable. In certain cases the contraction is so extreme and the relaxation is so pronounced that these individuals find great difficulty in attaining the proper muscle balance. This is frequently seen in marked atony of the abdominal muscles.

Children from eighteen months to two and one-half years of age are sometimes seen with extreme abdominal relaxation associated with disturbances of nutrition. It is of course a fallacy to expect children of this age to develop active postural exercises and it is believed that a wide abdominal belt which will not increase the lumbar lordosis, is of decided benefit. As soon as they can appreciate the necessity for exercises, these should be begun with an idea of discarding the mechanical appliance at an early date. Certain cases of extreme disturbance of a mechanical function of the body in older children do not respond to corrective measures, apparently because of lack of general muscle tone. A spring back brace is justifiable in such cases, because, as in wrist drop, splinting prevents the overstretching of weakened and relaxed muscles. However, such an appliance is not to be considered as a permanent correction, and the idea must be borne in mind constantly that it is to be discarded and is

only a temporary feature of the management of the case.

Perhaps a discussion of rest periods is not entirely within the realm of the orthopaedic surgeon, but suffice it to say that periods of rest in positions of overcorrection are a necessary part of the treatment and are partly responsible for the gains in weight which these cases of faulty attitude have exhibited.

Those of us who are seeing these children from time to time, are obligated to recognize and correct these cases of improper body attitude. The parents must be re-educated; the majority believe that the child will outgrow these bodily defects. That this is not the case was definitely proved during the recent active military period, when supposedly the physically fit of our country were subject to physical examination. The statistics showing the enormous number of individuals who were mechanically imperfect, certainly do not reflect credit upon our country. Only in recent years have exercises in educational institutions considered in any way the production of a perfect mechanical body. Our exercises have been splendid to develop endurance and tenacity, for which the American is so well known, but we should not lose sight of the fact that the body is a mechanical form and will operate much better if it is allowed to develop along true mechanical lines.

Suction in the Treatment of Laryngeal Diphtheria

—In an effort to avoid intubation, Harry R. Litchfield and Reginald P. Hardman, New York (Journal A. M. A., Feb. 24, 1923), in the past permitted patients to remain dyspneic for hours, sometimes to the point of exhaustion, struggling for air, hoping that they might ultimately expel the membrane, or that the antitoxin might check its rapid formation. At present they employ suction promptly, and as frequently as indicated. The patient is wrapped in a mummy bandage as for intubation, and through a Jackson laryngoscope the membrane and mucus are aspirated by means of a sixteen to eighteen French silk or metal catheter, which is connected to an aspirating bottle, and in turn connected to an ordinary electric suction pump, capable of producing from five to ten inches of vacuum. From May until the last part of December, 1922, 106 patients with laryngeal diphtheria were admitted to the croup service at Willard Parker Hospital. There were twenty-one mild cases which required no treatment. Twelve patients received applicator treatment. Intubation was performed in eighteen cases. Nine patients received suction and intubation. There were forty-six cases in which suction was used exclusively. The total number of deaths was fourteen, a mortality of 13+ per cent. Of the eighteen patients subjected to intubation, eight died with terminal bronchopneumonia. Three of these were moribund on admission; eight have been discharged cured, and two are still in the hospital, and cannot go out without their tubes for any considerable length of time. Two patients who underwent tracheotomy died. Of the nine patients treated by suction and intubation, two died, and the rest recovered. Both patients had bronchopneumonia on admission. The remaining two deaths occurred in the series in which suction was used exclusively. Both these patients had toxic tracheobronchial diphtheria. They were ill about four days before admission; one had, in addition, a pharyngeal involvement. Suction is especially advocated for cases in which there is a low membrane, which cannot be reached by either intubation tube or tracheotomy.